EMBRYOLOGY.[1]

Eggs of Nematodes.—Hans Spemann contributes to the May number of the Zoölogische Jahrbücher an elaborately illustrated account of the cleavage of the eggs of the Nematode *Strongylus paradoxus*. In general it is a confirmation of the results obtained by Boveri upon *Ascaris megalocephala*.

The egg divides into two equal cells, yet one contains all the yolk. Each divides into two and the four so produced become rearranged in a characteristic way.

Tho two cells from the one containing no yolk divide into right and left cells that increase to form the major part of the ectoderm at the period of gastrulation. One of the other two cells gives rise at its first division to entoderm and mesoderm, while the other produces four, of which three add themselves to the ectoderm and one remains as the originator of the sexual cells.

The author compares this cleavage to the divisions of an apical cell in a plant; the egg divides off an entoderm cell, a mes-entoderm cell and ectoderm cell, another ectoderm cell and finally remains as the origin of the sexual cells. The sexual cells may be thus readily traced backed to their ancestors amongst the blastomeres. They are separated as special cells in the fourth generation, starting from the undivided egg.

In this process of rapid separation of sexual and somatic cells, Boveri found in *Ascaris megalocephala* a peculiar nuclear differentiation. At the first cleavage the nucleus of one cell looses part of its chromatin and its chromosomes undergo a change of shape. The other cell undergoes a like change when divided, and so on till after five divisions all the cells but one have the modified nuclei. This cell with the unchanged nucleus becomes the the beginning of the sexual cells.

This remarkable nucleus differentiation has been sought for by Oscar Meyer[1] in the eggs of other nematodes namely, *Ascaris lumbricoides*, *A. rubicunda*, *A. labiata*, *A. mystax*, *A. perspicillum*, *Strongylus tetracanthus*, *S. paradoxus* and *Oxyuris vermicularis*. In the first three he finds essentially the same process as in the species studied by Boveri,

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Jenaische Zeitschrift., 29, May 15, 1895.

in the other cases the material was not suited to a decision on this point; the author thinks this differentiation between the nuclei of somatic and sexual cells may well be common to all the Ascaridæ.

A second subject taken up by Oscar Meyer in this paper is the origin of the centrosomes in the eggs of *Strongylus tetracanthus*. By the methods employed no centrosome could be found near the female pronucleus. The sperm-head is, on the other hand, accompanied by a very marked system of radiations surrounding an evident centrosome. As the male pronucleus approaches the female pronucleus two systems of radiations and two centrosomes are formed by the division of the single centrosome that accompanied the male pronucleus. When the pronuclei are united these two centrosomes become the centrosomes of the first cleavage spindle. In some abnormal cases the female pronucleus has a centrosome close to it, but this probably migrates from the male pronucleus. It thus seems that in this egg the centrosomes arise only in connection with the sperm.

The third problem taken up by the author is the question as to the nature of the difference between the two kinds of *Ascaris megalocephala*. Boveri found that some individuals have two chromosomes in each egg or sperm while others have but one. The former have been called the variety *bivalens*, the latter *univalens*.

Oscar Meyer examined 154 horses and found 19 infected with this parasite, 10 with the variety *univalens*, 8 with *bivalens* and 1 with both *univalens* and *bivalens*.

A careful examination of the external and internal anatomy and histology of both kinds failed to reveal any difference except in the sexual products. The eggs of *bivalens* measure 78–88 and those of *univalens* only 65–70 microns. The sperms are larger in *bivalens* and have a nucleus twice as large as in *univalens*.

The two kinds are very closely related and may, it seems, interbreed; at least the occurrence of eggs with three chromosomes as well as the finding of eggs of *univalens* penetrated by very large sperms points to such a conclusion. Copulation between the two kinds seems established by the discovery of worms with both sizes of sperms in the same egg-tube. A consideration of the numbers of apparent crosses so formed as compared with the possibilities that result from the presence of both kinds of sperm, leads to the conclusion that the crosses are not as frequent as they might be and that there may be some impediment to interbreeding. In other words the two kinds of Ascaris seem to be somewhat separated as physiological varieties in spite of their very close morphological relationship.

Cell Phenomena in the Triton Egg.—Following in the steps of Drüner Dr. H. Braus[2] of Jena, has made a careful study of cell division in the blastula stage of *Triton alpestris*. By special methods the achromatic spindles and polar radiations of cell division are brought out with great distinctness. In the spindle three kinds of fibers may be present; delicate fibers that aid in moving the chromosomes; fibers with a sheath, also pulling the chromosomes; and stout fibers that connect the two centrosomes and serve as a supporting system tending to resist the pressure exerted by the other fibers.

In the later blastula with several layers of cells just as in the gastrula and in the adult testis as made out by Drüner, the arrangement of the fibers in the spindle is such that the contracting ones that act upon the chromosomes form the mantle or outer part, while the pressure-resisting fibers form the axial part of the spindle.

In the early blastula, however, cell division is different; the spindle has its contracting fibers in the axial part and the resisting fibers in the outer part or mantle.

The author comes to the conclusion that the more primitive form of spindle is that found in the older stages of the ontogeny of the Triton.

In the same way the author thinks that the origin of the spindle within the nucleus in the early stages of the development of the Triton's egg is a cœnogenetic process, while its origin outside the nucleus, in the protoplasm of the cell, in the later stages and in the adult testis is really the more primitive method of spindle formation. In general the formation of a spindle within the nucleus is to be regarded as a recent innovation, not as the original method.

The very important question as to the reason for form in organisms, the laws of growth of organisms, receives a contribution from the author's decision that the position of the spindles in the Triton's blastulæ (the angle which the axis of the spindle forms in successive cell divisions) does not necessitate the arrangement of the cells to form parts and organs. The author shows that the position of the spindles would not give rise to sets of cells placed as they are in the two-layered blastulæ if there were no rearrangements of the cells after division. It is change in position of cells after their formation and not forces in the processes of cell division that leads to the growth of form.

In this Triton as many as nine sperms may enter one egg. These supernumerary sperms give rise, the author maintains, to certain extra nuclei recognizable even up to the blastula stage, so that the possibility of polyspermy having some lasting effect in the embryo receives some material basis.

[3] Jenaische Zeitschrift., May 15, 1895.